FINAL

First Five-Year Review Report

For

Helena Chemical Co. Landfill
City of Fairfax, Allendale County, South Carolina

PREPARED BY

United States Army Corps of Engineers, Charleston District
Charleston, South Carolina

FOR

United States Environmental Protection Agency
Atlanta, Georgia

April 2004

Approved by _____ Date 9/7/04

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List of Acronyms

ARARs	Applicable or Relevant and Appropriate Requirements
AST	Above-ground storage tank
BGS	Below Ground Surface
BRA	Baseline Risk Assessment
BQL	Below Quantitation Limits
CATOX	Catalytic Oxidation
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
ERM	Environmental Resources Management
ESD	Explanation of Significant Difference
FS	Feasibility Study
GETS	Groundwater Extraction and Treatment System
GPM	Gallons Per Minute
GWCC	Ground Water Cleanup Criteria
HASP	Health and Safety Plan
MDL	Method Detection Limit
MCL	Maximum Contaminant Levels
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OUs	Operable Units
PLC	Programmable Logic Controller
PRP	Potentially Responsible Party
RA	Remedial Action
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SCDHEC	South Carolina Department of Health and Environmental Control
SCRDI	South Carolina Recycling and Disposal, Inc
SVE	Soil Vapor Extraction
SVOCs	Semi-Volatile Organic Compounds
USACE	U S Army Corps of Engineers
USEPA	U S Environmental Protection Agency
VOCs	Volatile Organic Compounds

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Executive Summary

The selected remedy for the Helena Chemical Company Landfill site in Fairfax, South Carolina included excavation of contaminated soils and sediments on site, institutional controls, and extraction of contaminated groundwater by means of a single recovery well The site achieved construction completion with the signing of the Preliminary Closeout Report on July 29, 1999

The assessment of this five-year review found that the remedy was constructed in accordance with the September 8, 1993 Record of Decision (ROD) and the September 1, 1995 and February 11, 1999 ROD Amendments The remedy is functioning as designed

Soil and Sediments

The remedy is protective of human health and the environment All remedial actions were completed in 1999

Groundwater

The implemented groundwater treatment system is expected to achieve both objectives as outlined in the Final Design Report (Ensafe, 1997), ROD, and the ROD amendments to prevent the migration of contaminants beyond the present extent of the contaminant plume and, over time, to remove the most heavily contaminated groundwater from beneath the central portion of the site

The immediate threats have been addressed and the remedy is expected to be protective of human health and the environment when the groundwater cleanup goals are achieved through extraction by means of a single recovery well The expected time frame to achieve these goals is 10 – 20 years

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Five-Year Review Summary Form

Site Name: **Helena Chemical Co. Landfill**		EPA ID **SCD058753971**
Region **04**	State **South Carolina**	City/County **Fairfax, Allendale County**
LTRA* (highlight) Y **N**		Construction Completion Date **09/99**
Fund/PRP Lead **PRP**		NPL Status **Final 02/21/90**
Lead Agency **EPA Region 4**		
Who conducted the review (EPA Region, state, Federal agencies or contractor) **US Army Corps of Engineers, Charleston District**		
Dates review conducted **From 3/04 To: 4/04**		Dates of site visit **4/20/2004**
Whether first or successive review **First Review**		
Circle **Statutory** Policy		Due Date **September 13, 2004**
Trigger for this review(name and date) Five years from construction start of OU1 groundwater remediation		
Recycling, reuse, redevelopment site (highlight) Y **N**		

Issues:

The Administrative Record was not available for viewing by the public at the Fairfax City Hall as stated in section 1 6 of the Record of Decision

Recommendations and Follow-up Actions

A copy of the Administrative Record will be placed at the Fairfax City Hall for public viewing

Due to the continued presence of on-site contaminants in the shallow aquifer, the current schedule of monitoring for contaminant concentrations should be maintained

Protectiveness Statement(s):

The remedy is expected to be protective of human health and the environment The groundwater extraction system is expected to meet the remediation goals set forth in the September 8, 1993 Record of Decision (ROD) and the September 1, 1995 and February 11, 1999 ROD Amendments All remedial actions taken at the site were functioning as designed and were operated in an appropriate manner

Other Comments:

None

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Helena Chemical Company Landfill
City of Fairfax, Allendale County, South Carolina
First Five-Year Review Report

I. Introduction

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment The methods, findings, and conclusions of reviews are documented in Five-Year Review reports In addition, Five-Year Review reports identify issues found during the review, if any, and identify recommendations to address them

The Environmental Protection Agency has tasked the U S Army Corps of Engineers to prepare this Five-Year Review report pursuant to CERCLA §121 and the National Contingency Plan (NCP) CERCLA §121 states

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews

The Agency interpreted this requirement further in the NCP, 40 CFR §300 430(f)(4)(ii) states

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action

This is the first five-year review for the Helena Chemical Co Landfill site The trigger for this statutory review is the passage of five years since the completion of construction and the start of the O&M of the groundwater remediation system The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure

Note Throughout this report, text has been extracted, summarized and /or edited from the following documents concerning the Helena Chemical Co Landfill, EPA Record of Decision (including amendments), Final Design Report (Ensafe), Remedial Action Work Plan (Ensafe), Ecological Risk Assessment (Ensafe), Landfill and Wetland Remedial Action Report (Ensafe), and various groundwater-monitoring reports (Ensafe)

II. Site Chronology

Table 1. – Chronology of Site Events.

Event	Date
Agricultural Pesticide Production	1960's -1978
Discovery	June 1, 1981
Preliminary Assessment	September 1, 1982
Site Inspection	September 24, 1985
Proposal to NPL	June 24, 1988
RI/FS Negotiations	March 31, 1989
Consent Agreement	April 12, 1989
Final Listing on NPL	February 21, 1990
Removal Assessment	September 3, 1991
Final Remedial Investigation Report	December 31, 1992
Record of Decision	September 8, 1993
PRP RI/FS	September 8, 1993
Administrative records	September 22, 1993
RD/RA Negotiations	May 25, 1994
Unilateral Administrative Order	June 14, 1994
ROD Amendment (First Amendment)	September 1, 1995
Final Design Report	April 30, 1997
PRP RD	May 28, 1997
Wetland Remedial Action	
Berm Excavation	September 16, 1998
Site Restoration	October 13, 1998
Landfill Remedial Action	October 30, 1998
Landfill Excavation	October 30, 1998
"Highly Concentrated Waste" Incineration	October 21, 1998
ROD Amendment (Second Amendment)	February 11, 1999
Contaminated Soil Transported to Sarnia Hazardous Waste Landfill	March 17, 1999
Site Restoration - Landfill Backfilled, seeded with grass	March 17, 1999
Preliminary Close-out REP Prepared	September 13, 1999
PRP RA	September 13, 1999
Groundwater Remedial Action	
Start Operation	September 1999
Installation of Meter to assess actual pumping time	December 1999
System struck by Lightning/ Shutdown	June 2000
Pump Replaced / System Restart	October 2000
System Shutdown at request of Town of Allendale due to pH issue	December 17, 2000
pH issue resolved / System Restart	January 2001
Reduced Pump Yield Detected	December 2001
System Shutdown / Pump Removed	January 2002
System Restart	April 29, 2002
Reduced Pump Yield Detected	August 3, 2003
System Shutdown / Pump Removed	September 23, 2003
System Restart	October 9, 2003

III. Background

Physical Characteristics

The Helena Chemical Superfund site, located in Fairfax, South Carolina consists of 13 5 acres adjacent to Highway 321 A general location map is presented in Attachment 1 Located at the facility is a former landfill, which contains pesticide residues, and other waste materials generated on-site The former landfill occupies approximately four (4) acres on the northeast portion of the Fairfax property The location of the landfill in addition to other site structures is illustrated in Attachment 2 A chain link security fence topped with barbed wire encircles the site A city water well that is utilized by a population of approximately 2,300 is located 200 feet north west of the property

Land and Resource Use

Residential, agricultural and light industrial areas surround the site Beyond these areas immediately surrounding the site (including the City of Fairfax), the local area is not densely populated, and consists primarily of agricultural land and forests There are no potable water supply wells on the site, although there is a municipal water supply well located less than one-quarter mile away Information gathered from census data regarding population trends in Allendale County and surrounding areas suggests that future land use will remain commercial and industrial, with little potential for residential use of groundwater as a potable water source

Two buildings remain on the Fairfax property, the north warehouse and the office The south warehouse was torn down in April 2004 The north warehouse, which was once utilized to house the liquid insecticide formulation operation, is currently used to store various pesticides, herbicides, and fertilizers, which are sold to farmers Solvents used in the formulation process were delivered to the site by rail car via a rail spur, which was used to serve the facility The solvent tanks are no longer present; however, the concrete slab on which the tank saddles rested still exists The remains of a tank farm, which was used to store the technical grade pesticide compounds are located on the east side of the liquid formulation building Only the concrete pads on which the tanks rested and a retaining wall remain

The ground waters underlying the site are considered to be Class IIB ground waters under the draft EPA Guidelines for Ground-Water Classification, indicating that they are a potential source of public water supply These ground waters are also classified as Class GB ground waters under South Carolina regulations. The ground water has been contaminated to levels that render it a threat to public health should it ever be used for potable water supply and which exceed state ambient standards for Class GB ground waters Ongoing sampling has to date revealed no site-specific contamination in the nearby municipal water supply well

Site Topography and Drainage

The local topography of the Fairfax area exhibits little relief The Helena Chemical property slopes slightly to the north North of the property is a topographically low area that collects surface water during period of high rainfall Additionally, surface water from the facility drains into a small ditch that parallels the property to the northwest This ditch carries the water to Duck Creek, a tributary located northwest of the property, which in turn flows into the Coosawhatchie River located to the west of the Fairfax property The creek and the river are located within a three (3) mile radius of the site

Climate

The relatively temperate climate of Fairfax is typical of the South Carolina coastal plains region This is largely due to the close proximity of the Atlantic Ocean and its warm Gulf Stream current flowing northward near the southeastern border of the state creating a warming effect on the region Data provided by the South Carolina State climatology office indicated the annual mean temperature in the vicinity of Fairfax is 65 1°F The mean annual precipitation of Fairfax is approximately 47 95 inches Prevailing winds in the Fairfax area exhibit seasonal variations In the spring, southwest winds are predominate, summer, south and southwest winds prevail, autumn, prevailing winds are from the northeast, and in winter, northeast and southwest winds have close to the same frequency Average wind speeds throughout the year range from 6 to 10 miles per hour (Climate Report No G5, S C State Climatology Office, May 1990)

Geology and Hydrogeologic Setting

Site-specific geological and stratigraphic data were developed during the installation of test borings and monitoring wells Three distinct stratigraphic units were observed in the upper 145 feet of unconsolidated sediments encountered at the site, and a fourth may be present

The lowermost stratigraphic unit identified during the investigation was a gray to green, fine-grained clayey sand interbedded with clay laminae and numerous shell fragments The unit was moist, but did not exhibit the saturated properties as seen in the overlying sands Based on lithology, this unit is presumed to be the upper portion of the McBean/Santee Limestone Formation The observed thickness of this unit was approximately 45 feet The maximum thickness of this formation was not determined during the investigation

Overlying what is presumed to be the McBean Formation is a predominantly yellow to gold, fine to coarse sand This unit is also characterized by numerous shell fragments interspersed among the sand grains These sands are thought to be a member of the Barnwell Group The Barnwell Group is comprised of the Tobacco Road Sand and the Dry Branch Formation Recent investigations have indicated that the contact between the formations is a one to three foot thick layer, of coarse sand and gravel This gravel layer

was not positively identified in any of the borings, therefore, distinct facies changes were not stratigraphically identified during the RI.

Overlying the sands of the Barnwell Group is light gray and green medium sand, which in some locations graded to a coarse tan sand with some pebbles and shell fragments The lower contact between the formations was distinguished by a silicified shell hash in other locations The sands graded in a fining upward sequence to a very fine to medium grained sand intermingled with a dense red, orange, and gray mottled clay These sediments are characteristic of what is thought to be the Duplin Formation

Based on boring logs, there appears to be a lateral facies change to the north of the landfill Surface soils north of the landfill consist of a dark gray, dense clay Due to limited information, it is unclear whether the detrital sand underlying this area is a continuation of the Duplin or if a portion of the Duplin has been eroded and the sand a product of more recent depositional processes

The highest yielding aquifer in the area surrounding Fairfax is found within the sands of the Cape Fear, Middendorf, and Black Creek Formations These regional aquifers are some of the most permeable units in the stratigraphic column, providing large quantities of water for both municipal and private use

The high clay content of the Black Mingo Formation results in relatively low permeability This has led to the designation of the formation as an aquitard or aquiclude Some small domestic wells, however, may be utilizing water from more permeable portions of the Black Mingo

Although previous studies have indicated the McBean was not thought to be important as a public or commercial source, member beds within this formation produce sufficient water for use The Town of Fairfax south municipal well is screened within the McBean/Santee Formation A pumping test on the municipal well conducted by the city engineers indicated a transmissivity of 500 square feet per day at a pumping rate of approximately 298 gallons per minute The overlying sands of the Barnwell Group have been described as a relatively low permeability, low yielding aquifer that is used primarily for domestic water supply. The Barnwell underlying the site, however, is recognized as highly permeable, saturated sand

Previous investigations tentatively identified the presence of the Cooper Marl at the site Recent investigations, however, have indicated that the surficial sediments are characteristic of the Duplin Formation of Miocene age The upper portion of the Duplin Formation appears to be acting as an aquitard at the site

History of Contamination

Between the years of 1971 and 1978, Helena used the Fairfax facility for the formulation of liquid, and some dry, agricultural insecticides Prior to the ownership by Helena Chemical Company (beginning in 1971), two other chemical companies operated at the Fairfax facility Atlas Chemical Company, owned by Billy Mitchell (prior to the mid 60's), and then Blue Chemical Company, owned by Charles Blue (mid 60's through 1971) Both Atlas Chemical Company and Blue Chemical Company utilized the Fairfax facility for the formulation of insecticides Chemicals formulated and/or stored at the facility prior to Helena's ownership include DDT, aldrin, toxaphene, disulfoton, dieldrin, chlordane, BHC (benzene hexachloride), and ethoprop (Mocap) The Fairfax facility is presently being operated as a retail sales outlet and warehouse for agricultural chemicals Chemicals used in the previous formulation of insecticides by Helena at the Fairfax facility include toxaphene, methyl parathion, EPN (ethyl p-nitrophenyl thionobenzene-phosphonate), and disulfoton In producing the insecticides, the chemicals were formulated as mixtures with other ingredients including diesel fuel, aromatic solvents, and clays

Initial Response

In 1980, a former employee and a newspaper reporter notified the South Carolina Department of Health and Environmental Control (SCDHEC) that a waste dump was being operated by Helena Chemical At this time SCDHEC analyzed several soil samples from the site and found elevated levels of pesticides

In July 1981, SCDHEC issued a Notice of Violation to Helena for the operation of a waste disposal facility in violation of applicable South Carolina laws Helena and SCDHEC then entered into a Administrative Consent Order on October 1, 1981, where Helena agreed to perform a site investigation As a result of the investigation, Helena prepared a remediation plan as an amendment to the Administrative Consent Order dated March 12, 1984

As a result of the Administrative Consent Order dated March 12, 1984, approximately 500 cubic yards of contaminated soils were removed from the property and disposed of at a permitted hazardous waste landfill

The Hazard Ranking System (HRS) scoring was completed in June 1987, following a site screening investigation begun in 1985

Helena and EPA entered an Administrative Order by Consent (AOC) in April 1989, in which Helena agreed to perform a remedial investigation/feasibility study (RI/FS) Helena retained a contractor to perform the RI/FS which was started in May 1989, and finished in April 1992

The Helena site was proposed for listing on the National Priorities List (NPL) in June 1988, and was placed on the NPL in February 1990

In April 1992, approximately 1,000 cubic yards of contaminated soils were removed from the site, under the oversight of EPA, and transported to a permitted hazardous waste landfill

Following completion of the FS, EPA had a second public meeting on May 27, 1993 At this meeting, the public voiced concern over the possibility that contamination could enter their public water supply EPA also presented their selection of Preferred Alternatives

Basis for Taking Action

Contaminants

As shown in Table 2, the primary constituents of concern at the site include aldrin, alpha-BHC, beta-BHC, delta-BHC, gamma-BHC, DDT, DDD, DDE, dieldrin, endosulfan, endrin, endrin ketone,toxaphene, endosulphan sulfate, disulfoton, benzene, lead and chromium

Table 2. Hazardous Substances Found at Site.

Media	Contaminant	Contaminant Group
Debris, Sediment, Soil	4,4-DDD	Pesticides
Debris, Groundwater, Sediment, Soil	4,4-DDE	Pesticides
Debris, Groundwater, Sediment, Soil	4,4-DDT	Pesticides
Debris, Groundwater, Sediment, Soil	ALDRIN	Pesticides
Groundwater, Soil	ALPHA-BHC	Pesticides
Groundwater, Soil	BENZENE	VOC
Groundwater, Soil	BETA-BHC	Pesticides
Groundwater, Sediment, Soil	CAMPHECHLOR	Pesticides
Debris, Sediment, Soil	CHLORDANE	Pesticides
Groundwater, Soil	CHROMIUM	Metals
Groundwater, Soil	DDD	Pesticides
Groundwater, Soil	DDE	Pesticides
Groundwater, Soil	DDT	Pesticides
Groundwater, Soil	DELTA-BHC	Pesticides
Debris, Groundwater, Sediment, Soil	DIELDRIN	Pesticides
Debris, Groundwater, Sediment, Soil	DISULFOTON	Pesticides
Sediment, Soil	ENDOSULFAN	Pesticides
Groundwater	ENDOSULFAN II	Pesticides
Groundwater, Sediment, Soil	ENDOSULFAN SULFATE	Pesticides
Debris, Groundwater, Sediment, Soil	ENDRIN	Pesticides
Groundwater, Soil	ENDRIN KETONE	Pesticides
Groundwater, Soil	GAMMA-BHC	Pesticides
Sediment, Soil	HEPTACHLOR	Pesticides
Sediment, Soil	HEPTACHLOR EPOXIDE	Pesticides
Soil	LEAD	Metals
Groundwater	LEAD, INORGANIC	Metals
Sediment, Soil	METHOXYCHLOR	Pesticides
Groundwater	PESTICIDES	Pesticides
Groundwater, Soil	TOXAPHENE (POLYCHLORINATED	Pesticides

The EPA determined that the elevated levels of pesticides in the soils and ground waters at the site posed the primary hazard to human health at the site In addition the elevated levels of pesticides in the sediments and soils located in the wetland areas adjacent to and downstream of the site posed a hazard to environmental receptors inhabiting those areas The primary exposure pathways for humans were incidental dermal contact with and ingestion of contaminated soils, and ingestion of contaminated ground water

IV. Remedial Actions

Remedy Selection

The EPA signed a Record of Decision (ROD) in September 1993, addressing contaminated ground water, contaminated soil and waste material, and contaminated sediments in the adjacent wetland The major components of the selected remedy included

Source Control

- Excavation of contaminated surface and subsurface soil, with verification sampling, and,
- Treatment of the contaminated soils by means of hydrolytic/photolytic dechlorination and biological degradation, and,
- Placement of the treated soils into on-site excavations and,
- Site re-grading to prevent uncontrolled storm-water run off into waters of the State or the United States

Groundwater

- Extraction of contaminated groundwater from the surface (shallow) aquifer, and,
- Treatment and discharge of the treated groundwater to a local Publicly-Owned Treatment Works (POTW)

Mitigation for Adverse Impacts to Wetlands

- Mitigation for adverse impacts to environmental receptors in accordance with regulatory guidelines established under the authority of Section 404 of the Clean Water Act

Site Monitoring

- Quarterly sampling of groundwater and nearby public water supply to monitor the concentrations and movement of contaminants in affected and potentially affected aquifers

Contingency Remedy

- Low temperature thermal desorption (LTTD) was a contingency remedy for soil treatment, to be implemented if the chosen soil treatment technology proved incapable of achieving performance standards

The goal of removing the soil and landfill debris from the site, which was contaminated with chlorinated pesticides, was to mitigate risk to human health and the environment associated with the contamination The site soil Remedial Action Objective (RAO) was 50 milligrams per kilogram (mg/kg) total chlorinated pesticides and the wetland soil RAO was 5 mg/kg total chlorinated pesticides

The objectives for groundwater treatment at the site are to prevent the migration of contaminants beyond the present extent of the contamination plume and, over time, to remove the most heavily contaminated groundwater from beneath the central portion of the site Because the shallow aquifer is classified under the USEPA Guidelines for Groundwater contamination as a Class IIB groundwater (potential source of potable water supply), and as Class GB by the state, the RAOs for contaminated groundwater is to restore the affected aquifer as a potable water supply Criteria based upon protection of human health via drinking water exposure for site-specific contaminants of concern were established and constitute the RAOs for groundwater onsite These values are presented in Table 3

An amendment to the ROD was signed on September 1, 1995 This Amendment prescribed a change in the treatment alternative for contaminated soils and waste materials at the Helena Chemical Company Landfill

Treatability studies had shown that the previously recommended remedial action would not achieve the performance standards specified in the ROD Instead, off-site incineration at a permitted RCRA incinerator in Clive, Utah was chosen This new method was not only expected to achieve the performance standards set forth in the ROD, but to reduce costs as well This ROD amendment therefore changed the specified remedy for contaminated soils and wastes to the off-site incineration All other provisions of the original ROD were left in effect.

In preparation for these activities Helena representatives discovered that a licensed and regulated hazardous waste landfill in Canada was capable of receiving a portion of the contaminated soils from the site The Sarnia hazardous waste landfill, regulated by the Ontario Ministry of Environment and Energy, can accept waste not exceeding 20,000 parts per million of halogenated organic pesticides Pre-excavation sampling indicated that 34 of the 46 waste samples exhibited contamination below the cutoff level for Sarnia Helena then petitioned EPA to amend the 1995-ROD amendment to allow for portions of the site waste to be sent to Sarnia This reduced the overall remedy cost estimates from $3,517,000 (incineration only) to $2,361,900 (combination of incineration and landfill) A second ROD amendment was signed in February 1999

Table 3. Groundwater Remedial Action Standards.

Compound	ROD Established RAOs (ppb)
Aldrin	0 002
Benzene	5
alpha-BHC	0 006
beta-BHC	0 02
delta-BHC	0 006
Chlordane	2
Chromium	100
Dieldrin	0 002
DDT	0 1
DDD	0 1
DDE	0 1
Endrin	2
Lead	15
Lindane	0 2
Toxaphene	3
Heptachlor	0 4

Remedy Implementation

Elements of the site remedy that have been implemented are as follows

Soil / Landfill Remedy Implementation

On three occasions since 1983, soil and part of the landfill has been removed from the site In March 1984, approximately 500 cubic yards of contaminated soil were removed and transported to a permitted hazardous waste landfill In April 1992, approximately 1,000 cubic yards of materials were shipped to a secure Resource Conservation and Recovery Act (RCRA) landfill in Pinewood, South Carolina, and approximately 285 cubic yards of higher pesticide concentration material was disposed of at an RCRA-permitted incinerator in Port Arthur, Texas

On June 14, 1994 the EPA issued a Unilateral Administrative Order (UAO) directing remedial action at the site In the summer of 1995, a removal action was conducted at the Helena Chemical Co site Except for soil in and around the landfill, all site soil exceeding the removal standard of 50 mg/kg total pesticides as specified in the ROD, was excavated, and shipped to Laidlaw Environmental Services' incinerator facility in Clive, Utah Approximately 700 cubic yards of soil were excavated from the site and incinerated The soil removal and offsite disposal occurred in conformance with a ROD amendment signed in September 1995 Details of the removal are provided in the *Immediate Removal After Action Report* (October 1995)

Excavation of the landfill occurred during the timeframe of September 17 to October 30, 1998 Prior to backfilling the excavation, samples were taken from 57 locations in the landfill to determine if the RAO of 50-mg/kg total pesticide concentrations had been attained The sample concentrations ranged from 3 3 mg/kg to 42 7 mg/kg with an average of 12 1 mg/kg

Disposal of Debris Waste

Debris excavated from the landfill consisted of rusted, crushed 55-gallon drums and concrete, with some paper, plastic, and one rusted, crushed metal tank with a capacity of approximately 150 gallons Due to the amount of concrete recovered, it was proposed to USEPA that concrete removed from the landfill be used as backfill in the bottom of the excavation instead of being hauled offsite for disposal USEPA approved leaving concrete in the bottom of the excavation so long as it was covered with backfill soil As concrete was encountered it was removed from the excavation and stockpiled along the east side of the landfill, then all the concrete was placed in the landfill prior to the backfill material From September 21 to October 23, 1998, 31 loads of debris totaling 509 8 tons, were transported from the Fairfax site to the S-K Pinewood, South Carolina, landfill

Disposal of Incineration Waste

Per the February 1999 ROD amendment "highly concentrated waste" from the Fairfax site would be transported offsite for incineration From October 7 to 21, 1998, 45 loads of soil totaling 1,056 97 tons were transported from the Fairfax site to the S-K Deer Park, Texas, incinerator

Disposal of Sarnia Landfill Waste

In August 1998, Helena proposed shipping pesticide-contaminated soil to the landfill in Sarnia, Canada USEPA reviewed the request, asked for additional information, published a newspaper advertisement describing the proposal, and held a public meeting in Fairfax on November 12, 1998, to discuss it On February 11, 1999, the USEPA amended the ROD to permit pesticide-contaminated soil from the Helena Fairfax site to be transported and disposed of at the Sarnia, Ontario, Canada, landfill All wetland and landfill excavation and restoration activities were complete by November 4, 1998, so the stockpiled soil proposed for disposal at the Sarnia landfill remained untouched from November 1998 to February 1999 During this time, personnel monitored the plastic sheeting over the stockpile and repaired or replaced it as needed From February 17 to March 17, 1999, 308 loads of soil totaling 7,172 29 tons were transported from the Fairfax site to the S-K Sarnia, Ontario, Canada, landfill

Groundwater Remediation Implementation

During the April/May 1995 preliminary design investigation, the aquifer was tested to fulfill two objectives (1) to establish the nature of groundwater representative of full-scale extraction, and (2) to obtain best estimates of hydraulic conductivity, transmissivity, and storativity of the shallow aquifer for use in extraction system design A single recovery well, RW-1, was installed for the test

Various recovery wells scenarios were studied for implementation, however a single recovery well was determined to be sufficient The recovery rate was determined to 40 gpm The expected time frame for significant restoration of the groundwater is nine to 15 years Complete restoration may take much longer

Recovery System

The groundwater recovery system consists of one recovery well, RW-1 (shown in Attachment 1), fitted with an electrical submersible pump Recovered groundwater is pumped to an onsite sanitary sewer manhole Water flows by gravity to a Town of Fairfax lift station 200 feet to the northwest An electronic control panel regulates the pump, pump cycle, and low-water-level sensor The recovered groundwater is treated in the Town of Allendale's wastewater treatment plant under the terms of an industrial sewer use agreement A schematic of the recovery system design is shown in Attachment 2.

Recovery Well

The recovery well was installed during preliminary design (April/May 1995) Its placement is intended to remove VOC and dissolved pesticide mass and contain shallow contamination Routine water level measurements are used to record the actual radius of influence from the drawdown at the recovery well during start-up

System Operation and Maintenance

All pump maintenance is performed as instructed by the manufacturer A qualified water well driller and electrician conduct servicing

The following procedures are found in the Final Design Report

Pump
Periodically check pump to make sure it runs
Turn pump on and off to determine if controls work

Level control (Well)
Make sure float switch works Turn pump off, see if pump cuts on as water level rises

Level Control (Manhole Interlock)
Check level controls for the manhole interlock to the pump Let the manhole fill and trigger shut-off float Make sure pump shuts off

Flow meter
Check batteries
Check display

General
Visual inspection of piping for leaks
Visual inspection of well head for damage
Check pressure gage to ensure its working
After power outage, check to see that the pump has restarted
Check fuses

Maintenance Procedures
If component is damaged or broken, replace the component All work should be performed by a qualified plumber and / or electrician

System Modifications
The flow meter mentioned above did not work correctly, and was replaced with a hour meter in mid-December 1999 to measure actual run-times

The following is a summary of recovery well operation and maintenance (O&M) activities performed on a monthly and yearly basis

Routine O&M Procedures
Recovery well operations are monitored monthly with regard to discharge water quality and discharge volume Samples of recovery well water are collected from the discharge point at the sanitary sewer Discharge volume is determined by a flow meter and pump hour meter readings are recorded monthly by the sampling crew Recovery well discharge rates are measured annually during the sediment and groundwater sampling event Measurement of recovery well discharge rates are performed by recording the time required to fill a 5-gallon pail lowered beneath the well discharge point in the sanitary sewer Several readings are made and averaged to determine actual discharge rate

2003 Modified O&M Plan
Following pump inspection and cleanout in 2003, Helena Chemical Co developed the following protocol to minimize system downtime and optimize pump performance

Preventive maintenance (PM) is to be performed on a regular 12-month schedule (in conjunction with annual groundwater monitoring) to address the buildup of slime and iron deposits in both the pump and riser discharge line

PM will require

- pulling the discharge line and pump
- removal of the pump unit from the motor for onsite disassembly, cleaning, and reassembly
- reinstallation of the pump
- reassembly of the discharge line connections and use of Teflon tape or thread compound to prevent loosening of threads and leaks in the discharge line riser
- returning the well to service

The contractor will remain onsite until the pump is ready for reinstallation The pump should not require return to a repair vendor for several years if preventive maintenance is performed to reduce buildup of slime and iron deposits based on results of the wear evaluation

System Operation and Maintenance Costs

As shown below in Table 4, the majority of the O&M costs occurred during May 1999 The costs were unusually high due to the then ongoing remedial action, monitoring, legal action, etc Since then the O&M costs have averaged $7,230 per month

Table 4. Summary of Operation and Maintenance Costs.

Month	1999	2000	2001	2002	2003	Total
January	---	$2,852	$438	---	$971	$4,261
February	$26,497	$14,933	$2,388	$1,545	$3,650	$49,013
March	$14,074	$16,512	$3,003	$5	$1,939	$35,533
April	$734,604	$326	$6,408	$1,328	$185	$742,850
May	$1,670,075	$6,447	$10,513	$11,905	$1,126	$1,700,066
June	$12,875	$6,207	$18,466	---	$168	$37,717
July	$21,524	$353	$3,261	$22,865	---	$48,004
August	$17,324	$3,638	$5,610	$20,150	$15	$46,737
September	$68,126	$4,790	$313	$6,123	$448	$79,801
October	$2,666	$9,931	$2,493	$6,365	$84,079	$105,534
November	$4,744	$10,120	$457	$13,578	$17,636	$46,535
December	$3,364	$14,606	$2,329	---	$6,429	$26,727
Total	$2,575,874	$90,715	$55,679	$83,864	$116,645	$2,922,778

V. Progress Since Last Five-Year Review

This was the first five-year review for the site

VI. Five-Year Review Process

The Helena Chemical Co Landfill Five-Year Review was conducted by the U S Army Corps of Engineers, Charleston District for the United States

Environmental Protection Agency, Region IV The Remedial Project Manager for the site is Al Cherry The following team member performed the review

- Kenneth See, P E

The Five-Year Review consisted of the following activities a review of relevant documents (Attachment 3), interviews with site related personnel such as the EPA Region IV Remedial Project Manager, personnel from Ensafe, SCDHEC, and an onsite inspection

Interviews

The following individuals were contacted in person or by phone as part of the Five-Year Review Contact information is provided in Attachment 4

EPA Region IV Remedial Project Manager, Mr Al Cherry
Mr Cherry was contacted several times during the review process and provided background information on the Helena Chemical Co Landfill site as well as potential contacts having additional knowledge of the site Mr Cherry also participated in the onsite visit on April 20, 2004

Environmental Engineer, SCDHEC, Ms Keisha Long
Ms Long participated in the onsite visit and provided input to the review process

Director, Engineering, Safety, Health and Environment, Helena Chemical Co , Ed Brister
Mr Brister was contacted initially by phone to discuss ongoing site operations, annual costs, health and safety documents, and took part in the onsite visit

U S Army Corps of Engineers, Regulatory Specialist, Mr Ed Bave
Mr Bave conducted the ARARs review and was contacted several times for his input regarding ARARs issues

Environmental Scientist, Ensafe, Inc , Mr Greg Temple
Mr Temple was contacted several times to obtain site related documents and to discuss ongoing operations at the site

NOAA COASTAL RESOURCE COORDINATOR, Dr Tom Dillon
Dr Dillon was contacted regarding any specific concerns he had regarding the site and to coordinate site visit(s)

Environmental Quality Manager, SCDNR, Ms Priscilla Wendt
Ms Wendt was contacted by phone to solicit any concerns she had regarding the site Ms Wendt also provided comments on the 5-Year Review Draft Report

Retail Store Manager, Helena Chemical Co , John Hewlett, Jr
Mr Hewlett was interviewed in person during the site visit Mr Hewlett was questioned regarding site conditions, and site security

Document Review

This five-year review consisted of a review of relevant documents including O&M records and monitoring of data (See Attachment 3) Applicable groundwater cleanup standards as listed in the 1993 Record of Decision were reviewed

Data Review

Groundwater Monitoring Data

Groundwater monitoring was conducted at the site in April 1995 and has been performed routinely at the site since April 1999 as outlined in the Remedial Action Work Plan (RAWP) (Ensafe, April 30, 1997) As shown in Attachments 5 and 6, the groundwater contours indicate the plume has been contained to the site Attachment 7 illustrates the expected capture zone after 1,000 days of continuous operation

As per SCDHEC, groundwater monitoring occurred semiannually for two years, after which, monitoring was performed annually Additionally, due to extremely low concentrations observed since April 1999, sampling of inorganic chemicals was discontinued in all wells and sampling for volatile organic chemicals was continued only for wells MW-3, MW-4, and MW-23 Data collected from monitoring wells MW-1, MW-2, MW-3, MW-4, MW-23, MW-17 and MW-18 are shown in Tables 5 through 11

A declining trend in some of the contaminant concentrations has yet to appear in the data as seen in Tables 5 through 11 This should not be construed that the implemented remedy is not effective, as too little time has past since the implementation of the remedy The objective of the remedy is to prevent migration of contaminants from the site and, over time, remove the most heavily contaminated groundwater from beneath the site in order to meet the groundwater remediation goals Pump and treat systems are notoriously inefficient and require long-term operation However, to ensure the remedy is protective and effective, monitoring efforts should continue

An area of particular concern is in the vicinity of the Fairfax Municipal well This well is set in the deep aquifer, approximately 350 feet below the ground and supplies drinking water to approximately 2300 people

Pumping rate test of the Fairfax municipal well indicate there is little communication between the upper and lower aquifers The ambient groundwater flow in the contaminated shallow aquifer is to the South Given this and the fact that the two aquifers are separated by 13 feet of shelly clay, there is little chance of contaminate migration reaching the municipal well

Sewer Monitoring Data

Sewer discharge sampling has been performed in accordance with Helena Chemical Co 's sewer-use agreement with the Town of Allendale POTW (Attachment 8) Currently, the groundwater flow rate and pH are sampled monthly, with sampling for xylene conducted quarterly and TTO monitoring conducted annually

The system was shutdown in April 2000 due to TTO exceeding permitted concentrations during the February, March and April 2000 sampling events The Town of Allendale raised the TTO limit and the system was restarted in May 2001 Additionally, in December 2000, the discharge to the sewer was terminated due to pH issues The minimum pH limit was lowered to 5 and the system was restarted in January 2001

Sediment Monitoring Data

Pesticide concentrations found in sediment within the wetland area have been monitored in accordance with the Remedial Action work Plan Samples are collected annually from 10 locations as indicated in Attachment 9 Prior to the 2003 annual monitoring, all sample locations had exhibited total pesticide concentrations below the RAO of 5 mg/kg. The August 2003 Grids E and I sampling had total pesticide concentrations of 7 24 mg/kg and 5 915 mg/kg All other sampling locations were below the 5 mg/kg RAO

Table 5. Groundwater Chemical Concentrations from Monitoring Well MW-1 (Deep).

	Monitoring Well MW-1							ROD RAO
Pesticides	**Apr-95**	**Apr-99**	**Nov-99**	**Aug-00**	**Feb-01**	**May-02**	**Aug-03**	**(ppb)**
Alpha-BHC	0 00028	0 01	ND	0 044	0 027	0 023	0 038	0 006
Beta-BHC	0 00067	0 02	0 0072	0 062	0 063	0 083	0 2	0 02
Delta-BHC	ND	0 0026	0 0023	ND	ND	0 0041	0 0058	0 006
Lindane	ND	0 02	ND	0 088	0 058	0 034	0 052	0 2
Heptachlor	ND	ND	ND	ND	ND	ND	ND	0 4
Aldrin	ND	ND	ND	ND	ND	ND	ND	0 002
Dieldrin	ND	ND	ND	ND	ND	0 0053	ND	0 002
4,4' DDE	ND	ND	ND	ND	ND	0 0029	ND	0 1
Endrin	ND	ND	ND	ND	ND	ND	ND	2
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND	0 1
4,4'-DDT	ND	0 0049	ND	ND	ND	ND	ND	0 1
Toxaphene	ND	ND	ND	ND	ND	ND	ND	3
Chlordane	ND	ND	ND	ND	ND	0 0029	ND	2
Organics								
Benzene	ND	ND	ND	ND	ND	NS	NS	5
Metals								
Chromium	1*	ND	ND	2 7	ND	NS	NS	100
Lead	1 9	ND	ND	ND	ND	NS	NS	15

Notes

* - Result is less than reporting limit but greater than instrument detection limit

ND - Not Detected, NS - Not Sampled

Table 6.
Groundwater Chemical Concentrations from Monitoring Well MW-2 (Shallow).

	Monitoring Well MW-2							ROD RAO
Pesticides	**Apr-95**	**Apr-99**	**Nov-99**	**Aug-00**	**Feb-01**	**May-02**	**Aug-03**	**(ppb)**
Alpha-BHC	0 0002	ND	ND	ND	ND	ND	ND	0 006
Beta-BHC	ND	ND	ND	ND	ND	ND	ND	0 02
Delta-BHC	0 00026	ND	ND	ND	ND	ND	ND	0 006
Lindane	ND	ND	ND	ND	ND	ND	ND	0 2
Heptachlor	0 00021	ND	ND	ND	ND	ND	ND	0 4
Aldrin	ND	ND	ND	ND	ND	ND	ND	0 002
Dieldrin	ND	ND	ND	ND	ND	ND	ND	0 002
4,4' DDE	ND	ND	ND	ND	ND	ND	ND	0 1
Endrin	ND	ND	ND	ND	ND	ND	ND	2
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND	0 1
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	0 1
Toxaphene	ND	ND	ND	ND	ND	ND	ND	3
Chlordane	ND	ND	ND	ND	ND	ND	ND	2
Organics								
Benzene	0 17	ND	ND	ND	ND	NS	NS	5
Metals								
Chromium	4 7	ND	ND	5 5	ND	NS	NS	100
Lead	ND	ND	ND	ND	ND	NS	NS	15

Notes
* - Result is less than reporting limit but greater than instrument detection limit
ND - Not Detected, NS - Not Sampled

Table 7.
Groundwater Chemical Concentrations from Monitoring Well MW-3 (Deep).

	Monitoring Well MW-3							ROD RAO
Pesticides	**Apr-95**	**Apr-99**	**Nov-99**	**Aug-00**	**Feb-01**	**May-02**	**Aug-03**	**(ppb)**
Alpha-BHC	0 64	1 7	1 3	0 21	0 17	0 088	0 11	0 006
Beta-BHC	0 11	0 62	0 65	0 46	0 42	0 35	0 41	0 02
Delta-BHC	0 028	0 17	0 13	ND	ND	ND	ND	0 006
Lindane	0 46	1 4	1 2	0 16	0 1	0 036	0 11	0 2
Heptachlor	0 0011	ND	ND	ND	ND	0 0039	ND	0 4
Aldrin	ND	ND	ND	ND	0 019	ND	ND	0 002
Dieldrin	0 0031	0 021	0 04	ND	ND	0 019	ND	0 002
4,4' DDE	0 001	ND	ND	ND	ND	0 0051	ND	0 1
Endrin	ND	ND	ND	ND	ND	0 0043	ND	2
4,4'-DDD	ND	ND	ND	ND	ND	0 011	0 018	0 1
4,4'-DDT	ND	ND	ND	ND	ND	0 037	0 011	0 1
Toxaphene	ND	ND	ND	ND	ND	ND	ND	3
Chlordane	0 0011	ND	ND	ND	ND	0 0056	ND	2
Organics								
Benzene	0 2	ND	3 2	ND	ND	0 77	0 14	5
Metals								
Chromium	1 2	ND	ND	11	6 5	NS	NS	100
Lead	1 9	ND	ND	ND	ND	NS	NS	15

Notes
* - Result is less than reporting limit but greater than instrument detection limit
ND - Not Detected, NS - Not Sampled

Table 8.
Groundwater Chemical Concentrations from Monitoring Well MW-4 (Shallow).

	Monitoring Well MW-4							ROD RAO
Pesticides	**Apr-95**	**Apr-99**	**Nov-99**	**Aug-00**	**Feb-01**	**May-02**	**Aug-03**	**(ppb)**
Alpha-BHC	2 9	8 8	4 3	15	1 4	2 7	6 3	0 006
Beta-BHC	16	15	12	16	13	7 8	11	0 02
Delta-BHC	3 6	4 3	3 2	5 7	2 8	1 5	2 8	0 006
Lindane	1 7	3 2	2 7	5 6	1	1 7	4 2	0 2
Heptachlor	0 061	ND	ND	ND	ND	ND	0 12	0 4
Aldrin	0 047	ND	ND	ND	0 46	0 16	0 32	0 002
Dieldrin	1	4 3	ND	4 5	2 8	2 2	6 9	0 002
4,4' DDE	0 052	ND	ND	ND	1 2	ND	ND	0 1
Endrin	0 022	ND	ND	ND	1 5	0 55	ND	2
4,4'-DDD	ND	0 12	0 5	ND	ND	ND	ND	0 1
4,4'-DDT	0 21	0 16	ND	ND	ND	ND	ND	0 1
Toxaphene	ND	ND	ND	ND	ND	ND	ND	3
Chlordane	0 047	0 19	ND	ND	ND	0 59	ND	2
Organics								
Benzene	0 13	3 4	ND	92	4 4	ND	ND	5
Metals								
Chromium	1 3	ND	ND	ND	ND	NS	NS	100
Lead	2	ND	ND	ND	ND	NS	NS	15

Notes
* - Result is less than reporting limit but greater than instrument detection limit
ND - Not Detected, NS - Not Sampled

Table 9.
Groundwater Chemical Concentrations from Monitoring Well MW-23 (Deep).

	Monitoring Well MW-23							ROD RAO
Pesticides	**Apr-95**	**Apr-99**	**Nov-99**	**Aug-00**	**Feb-01**	**May-02**	**Aug-03**	**(ppb)**
Alpha-BHC	0 0014	ND	0 016	0 26	0 041	0 0092	0 0082	0 006
Beta-BHC	0 01	0 099	0 14	0 33	0 63	0 096	0 12	0 02
Delta-BHC	ND	ND	0 0058	ND	ND	ND	ND	0 006
Lindane	ND	0 0023	ND	ND	ND	ND	ND	0 2
Heptachlor	0 0012	ND	ND	ND	ND	ND	ND	0 4
Aldrin	ND	ND	ND	ND	ND	ND	ND	0 002
Dieldrin	0 00058	ND	0 0041	ND	ND	0 0028	ND	0 002
4,4' DDE	ND	ND	ND	ND	ND	ND	ND	0 1
Endrin	ND	ND	ND	ND	ND	ND	ND	2
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND	0 1
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	0 1
Toxaphene	ND	ND	ND	ND	ND	ND	ND	3
Chlordane	ND	ND	ND	ND	ND	0 0033	ND	2
Organics								
Benzene	ND	ND	ND	0 53	0 165	ND	ND	5
Metals								
Chromium	17	ND	ND	5 8	ND	NS	NS	100
Lead	4	ND	ND	ND	ND	NS	NS	15

Notes
* - Result is less than reporting limit but greater than instrument detection limit
ND - Not Detected, NS - Not Sampled

Table 10.
Groundwater Chemical Concentrations from Monitoring Well MW-17 (Deep).

	Monitoring Well MW-17							ROD RAO
Pesticides	**Apr-95**	**Apr-99**	**Nov-99**	**Aug-00**	**Feb-01**	**May-02**	**Aug-03**	**(ppb)**
Alpha-BHC	ND	ND	ND	ND	ND	ND	ND	0 006
Beta-BHC	ND	ND	ND	ND	ND	ND	ND	0 02
Delta-BHC	ND	ND	ND	ND	ND	ND	ND	0 006
Lindane	ND	0 0028	ND	ND	ND	ND	ND	0 2
Heptachlor	ND	0 0016	ND	ND	ND	ND	ND	0 4
Aldrin	ND	ND	ND	ND	ND	ND	ND	0 002
Dieldrin	ND	ND	ND	ND	ND	ND	ND	0 002
4,4' DDE	ND	ND	ND	ND	ND	ND	ND	0 1
Endrin	ND	ND	ND	ND	ND	ND	ND	2
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND	0 1
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	0 1
Toxaphene	ND	ND	ND	ND	ND	ND	ND	3
Organics								
Benzene	ND	ND	ND	ND	ND	NS	NS	5
Metals								
Chromium	ND	2 3	ND	6 6	ND	NS	NS	100
Lead	2 1	ND	ND	ND	ND	NS	NS	15

Notes
* - Result is less than reporting limit but greater than instrument detection limit
ND - Not Detected
NS - Not Sampled

Table 11.
Groundwater Chemical Concentrations from Monitoring Well MW-18 (Shallow).

	Monitoring Well MW-18							ROD RAO
Pesticides	**Apr-95**	**Apr-99**	**Nov-99**	**Aug-00**	**Feb-01**	**May-02**	**Aug-03**	**(ppb)**
Alpha-BHC	0 18	0 15	0 02	0 16	0 092	0 022	0 078	0 006
Beta-BHC	ND	1 8	0 47	3	1 8	0 43	0 91	0 02
Delta-BHC	0 076	0 07	0 014	0 046	0 042	0 0072	0 016	0 006
Lindane	0 2	0 24	0 04	0 22	0 15	0 044	0 13	0 2
Heptachlor	ND	ND	ND	ND	ND	ND	ND	0 4
Aldrin	ND	0 049	0 013	ND	0 034	0 0041	0 018	0 002
Dieldrin	0 55	0 68	0 22	1 5	0 72	0 26	0 58	0 002
4,4' DDE	ND	ND	ND	ND	ND	0 017	ND	0 1
Endrin	ND	ND	ND	ND	ND	ND	ND	2
4,4'-DDD	0 036	ND	ND	ND	ND	ND	ND	0 1
4,4'-DDT	0 0069	ND	ND	ND	ND	ND	ND	0 1
Toxaphene	ND	1 8	ND	1 8	ND	0 92	1 3	3
Organics								
Benzene	ND	ND	ND	ND	ND	NS	NS	5
Metals								
Chromium	4 2	1 3	ND	4 5	ND	NS	NS	100
Lead	2 1	ND	ND	ND	ND	NS	NS	15

Notes
* - Result is less than reporting limit but greater than instrument detection limit
ND - Not Detected
NS - Not Sampled

Site Inspection

A site inspection was conducted on April 20, 2004 Representatives from the EPA, U S Army Corps of Engineers, South Carolina Department of Health and Environmental Control, and Helena Chemical Co took part in the inspections

During the inspections, mechanical systems such as the recovery well, and several monitoring wells were observed All of the observed monitoring wells were properly secured with padlocks The area formerly occupied by the landfill was observed for signs of distress such as erosion and settlement, but no problems were found The fence surrounding the site appeared to be in good condition No signs of vandalism or illegal entry to the site were noticed Photographs taken during the inspection are shown in Attachment 9 Additionally, the site inspection checklist is given in Attachment 10

ARAR Compliance Review

An ARAR review was performed for the site in accordance with the EPA guidance document, "Comprehensive Five-Year Review Guidance," EPA 540R-01-007, June 2001

Based on the narrative provided in the "Landfill and Wetlands Remedial Action Report" 7/21/1999, it is assumed that remedial action objectives for soil and sediment removal were met As is typical of many ROD's, a large percentage of ARARs and TBC's addressed in section 9 2 of the 1993 ROD and it's associated amendments, were directed at action and location specific requirements associated with on-site construction during the execution of the remedial action(s) It is assumed that all action- and location-specific ARARs were complied with during soil and sediment remediation activities Therefore, only ARARs and TBCs associated with the groundwater cleanup portion of the remedy have been evaluated in this five-year review The following is a summary of ARARs and TBCs abstracted from the 1993 ROD and relevant to ongoing O&M operations

Applicable Requirements

40 CFR 122, promulgated under the authority of the Clean Water Act Specifically Section 122 50, governing discharges to publicly owned treatment works (POTWs)

The Allendale sanitary sewer system operator has developed pretreatment discharge requirements for extracted ground water for the HCC site Low levels of contaminants in extracted groundwater have not warranted treatment on-site As long as the extracted ground water continues to meet established criteria for receipt by the municipality, this component of site O&M should remain protective

Relevant and Appropriate Requirements

Maximum Contaminant Levels (MCLs), 40 CFR 141 promulgated under the Safe Drinking Water Act These parameters are discussed further below

Criteria "To Be Considered"

Risk assessment processes were used to develop several of the ground water remedial action objects These TBC criteria were based on a 1 X 10^{-6} carcinogenic risk These parameters are discussed further below

Shown below in Table 3(Repeated) are the ground-water remediation standards given in Section 9 3 3 of the 1993 ROD

Table 3 (Repeated). Groundwater Remediation Standards.

Contaminant	Concentration (parts per billion,ppb)
Aldrin	0 002
Benzene*	5
Alpha-BHC	0 006
Beta-BHC	0 02
Delta-BHC	0 006
Chlordane*	2
Chromium*	100
Dieldrin	0 002
DDT	0 1
DDD	0 1
DDE	0 1
Endrin*	2
Lead*	15
Lindane*	0 2
Toxaphene*	3
Heptachlor*	0 4

Of the sixteen (16) remediation standards listed above, eight (8*) were developed from chemical specific ARARs (MCLs) while the remainder were developed based on risk Table 12 summarizes toxicity data from the 1993 ROD. Parameters defined as ground water remediation standards are in bold and changes in historic values (Slope factors, reference doses etc) associated with the 1993-ROD parameters compared to current (2004) values are also in bold type No differences between historic and current MCLs were found Table 11 provides a brief narrative summary of the changes and a qualitative assessment of impact

Table 12.
Original and Current Toxicity Data for Helena Chemical Company Superfund Site

	CSFo ORIGINAL		CSFo CURRENT		RfDo ORIGINAL		RfDo CURRENT		MCL
	1/mg/kg/d		1/mg/kg/d		mg/kg/d		mg/kg/d		
Chlordane	1 3		**.35**	i	0 00006		**0.0005**	i	0 002
Endrin	NA		NA		0 0003		0 0003	i	0 002*
Heptachlor	4 5		4 5	i	0 0005		0 0005	i	0 0004
Heptachlor Epoxide	9 1		9 1	i	0 000013		0 000013	i	0 0002
Disulfoton	NA		NA		0 00004		0 00004	i	NA
Benzene	0 029		**0.055**	i	NA		**.004**	n	0 005
Aldrin	17		17	i	0 00003		0 00003	i	NA
a-BHC	6 3		6 3	i	NA		0005	n	NA
ß-BHC	1 8		1 8	i	NA		0002	n	NA
gamma-BHC(Lindane)	1 3		1 3	h	0 0003		0 0003	i	0 0002
delta-BHC	NA		NA		NA		NA		NA
Dieldrin	16		16	i	0 00005		0 00005	i	NA
Endosulfan	NA		NA	i	0 00005		**0.006**	i	NA
DDD	0 24		0 24	i	NA		NA	i	NA
DDE	0 34		0 34	i	NA		NA	i	NA
DDT	0 34		0 34	i	0 0005		0 0005	i	NA
Toxaphene	1 1		1 1	i	NA		NA		0 003
TBPT[b]	NA		NA		NA		NA		NA
Methoxychlor	NA		NA		0 005		0 005	i	0 04
Chlorobenzilate	NA		**.27**	h	0 02		0 02	i	—
Chromium[d]	NA		NA		1 0		**1.5**	i	0 1
Lead[c]	NA		NA		0 0014		NA		0 015

Notes From 1999 Amendment to 1995 ROD Helena Chemical Company Superfund Site
a A proposed MCL of 0 002 mg/l (* assumed to be "a" in original table, Endrin MCL is now final)
b No verified risk based criteria exist for TBPT
c The unit risk for lead is calculated from a treatment technology based MCL of 0 015 mg/l A USEPA approved RfD for lead has not been established
d based on assumption that all chromium is present in the (III) valence state
e unit risk computed from MCL
NA Not available or not determined
Slope Factor synonymous to Cancer Potency Factor (CPF)
Current toxicity values as of 04/30/2004
Sources of toxicity values i = IRIS h = HEAST n = NCEA

Risk Characterization
CSFo = Oral slope factor
RfDo = Oral reference dose
CDI = Chronic Daily Intake
Risk = CDI x CSFo
Hazard = CDI/RfD

Table 13. HHA Risk Assessment Review

Change	Effect
RfDo increased for endosulfan (100x), chromium III	Decrease in overall hazard
CSFo increased and RfDo now available for benzene	Slight increase in risk and in overall hazard
CSFo decreased and RfDo increased (10x) for chlordane	A slight decrease in risk and decrease in overall hazard
CSFo now available for chlorobenzilate	A slight increase in risk

Based on the above summaries, there appears to be no significant changes that impact the protectiveness of the implemented remedy

VII. Assessment

Question A Is the remedy functioning as intended by the decision documents?

The review of documents, ARARs, risk assumptions, and the results of the site inspection indicate that the remedy is functioning as intended by the ROD and the ROD amendments

The excavation and disposal of contaminated soils and sediments from the site has been effective in removing contaminants from the site preventing contact with, or ingestion of, contaminants in soil and sediments The implemented groundwater treatment system is expected to achieve both objectives as outlined in the Final Design Report (Ensafe, 1997), ROD, and the ROD amendments to prevent the migration of contaminants beyond the present extent of the contaminant plume and, over time, to remove the most heavily contaminated groundwater from beneath the central portion of the site While many contaminant concentrations have been reduced, fluctuations in the chemical concentrations indicate the need for long-term operation of the recovery system

The institutional controls in place appear to be effective at preventing any interference with the implemented remedy

Question B Are the assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy

Changes in Standards and To Be Considereds

There have been no changes in the ARARs and no new standards that would affect the protectiveness of the remedy

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

No changes in the site conditions that affect exposure, toxicity or other contaminant characteristics were identified as part of the five-year review There are no current or planned changes in land use No new contaminants, sources, or routes of exposure were identified as part of this five-year review There is no indication that hydrologic / hydrogeologic conditions are not adequately characterized

Question C Has any any other information come to light that could call into question the protectiveness of the remedy?

No additional information has been identified that would call into question the protectiveness of the remedy

Technical Assessment Summary

According to the data reviewed, the site inspection, and the interviews, the remedy is functioning as intended by the ROD and both amendments There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy There have been no significant changes in toxicity factors for the contaminants of concern that were used in the baseline risk assessment, and there have been no significant changes to the standard risk assessment methodology that could affect the protectiveness of the remedy There is no other information that calls into question the protectiveness of the remedy

Pump and treat systems are notoriously inefficient and require long-term operation However, to ensure the remedy is protective and effective, operation of the pump and treat system and monitoring efforts should continue

VIII. Issues

No issues were uncovered that would affect the protectiveness of the remedy or the future protectiveness of the remedy However, one discrepancy was discovered during the five-year review process

The Administrative Record was not available for viewing by the public at the Fairfax City Hall as stated in section 1 6 of the Record of Decision

IX. Recommendations and Follow-Up Actions

A copy of the Administrative Record will be placed at the Fairfax City Hall for public viewing This follow-up action will not affect the current or future protectiveness of the remedy

Due to the continued presence of on-site contaminants in the shallow aquifer, the current schedule of monitoring for contaminant concentrations should be maintained

X. Protectiveness Statement

The remedy is expected to be protective of human health and the environment The groundwater extraction system is expected to meet the remediation goals set forth in the September 8, 1993 Record of Decision (ROD) and the September 1, 1995 and February 11, 1999 ROD Amendments All remedial actions taken at the site were functioning as designed and were operated in an appropriate manner

XI. Next Review

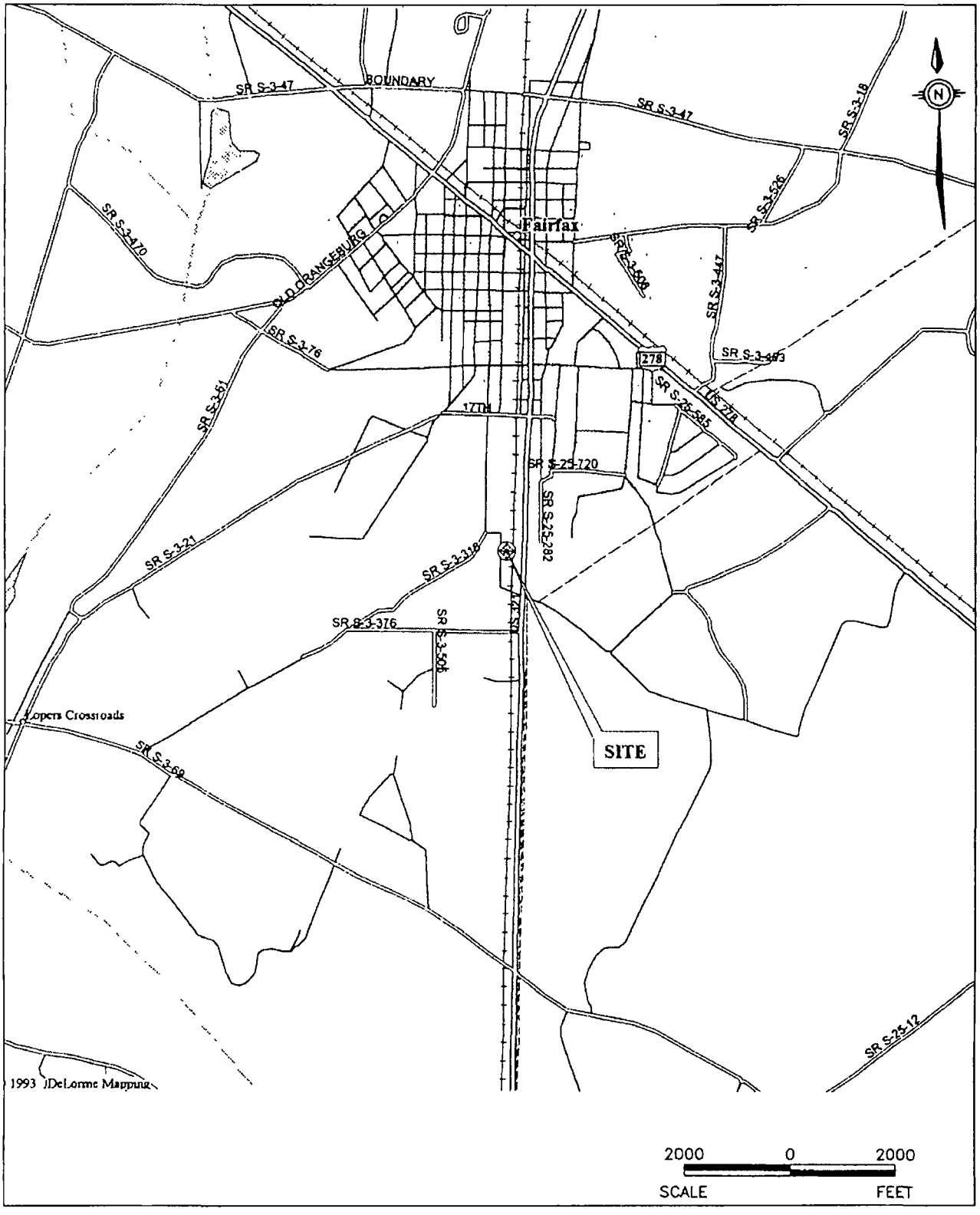
The next five-year review for the Helena Chemical Co Landfill site is due September 13, 2009, five years from the date of this review

FINAL

ATTACHMENTS

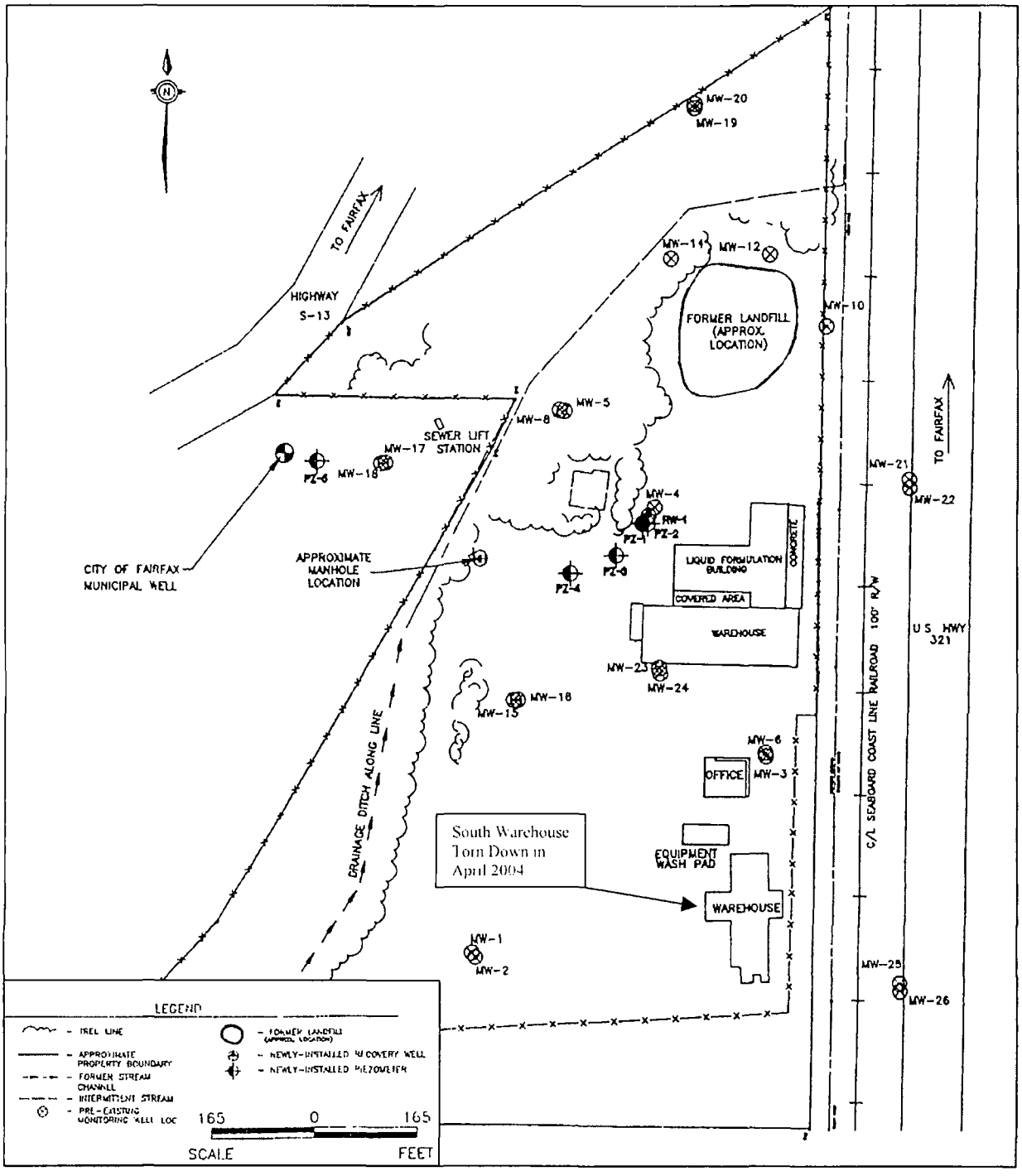
FINAL

Attachment 1 General Location Map



FINAL

Attachment 2. Site Map



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Attachment 3 Documents Reviewed.

Community Relations Plan, Dated 12/4/1989

1993 Record of Decision, Dated 9/28/1993

1995 Amendment to the Declaration for the Record of Decision, Dated 9/1/1995

Ecological Risk Assessment, Dated 2/5/1997

Remedial Action Work Plan, Dated 3/25/1997

Final Design Report, Dated 4/30/1997

Record of Decision Amendment, Dated 2/11/1999

Landfill and Wetland Remedial Action Report, Dated 7/21/1999

1999 Groundwater and Sediment Monitoring Report, Dated 7/10/2000

2000/2001 Groundwater and Sediment Monitoring Report, Dated 8/23/2001

2002 Groundwater and Sediment Monitoring Report, Dated 12/19/2002

Groundwater and Sediment Monitoring Report, Dated 3/2004

Various Effluent Sampling Results

FINAL

Attachment 4 Contact Information

Name	Organization	Address	Phone
Al Cherry	EPA, Region 4	61 Foryth Street,S W Atlanta, Georgia 30303	(404) 562-8828
John Hewlett, Jr	Helena Chemical Co	2376 Hampton Ave South Fairfax, SC 29827	(803) 632-2555
Ed Brister	Helena Chemical Co	225 Schilling Blvd , Suite 300 Collierville, TN 38017	(901) 537-8600
Kenneth See, P E	US Army Corps of Engineers	69A Hagood Ave Charleston, SC 29403	(843) 329-8059
Keisha D Long	SCDHEC	2600 Bull Street Columbia, SC 29201	(803) 896-4073
Ed Bave	US Army Corps of Engineers	12565 West Center Rd Omaha, NE 68144	(402) 697-2634
Greg Temple	Ensafe Inc	5724 Summer Trees Drive Memphis, TN 38134	(901) 372-7962
Dr Tom Dillon	NOAA	61 Forsyth Street Atlanta, GA30303	(404) 562-8639
Priscilla Wendt	SCDNR	217 Ft Johnson Road Charleston, SC 29412	(843) 953-9305

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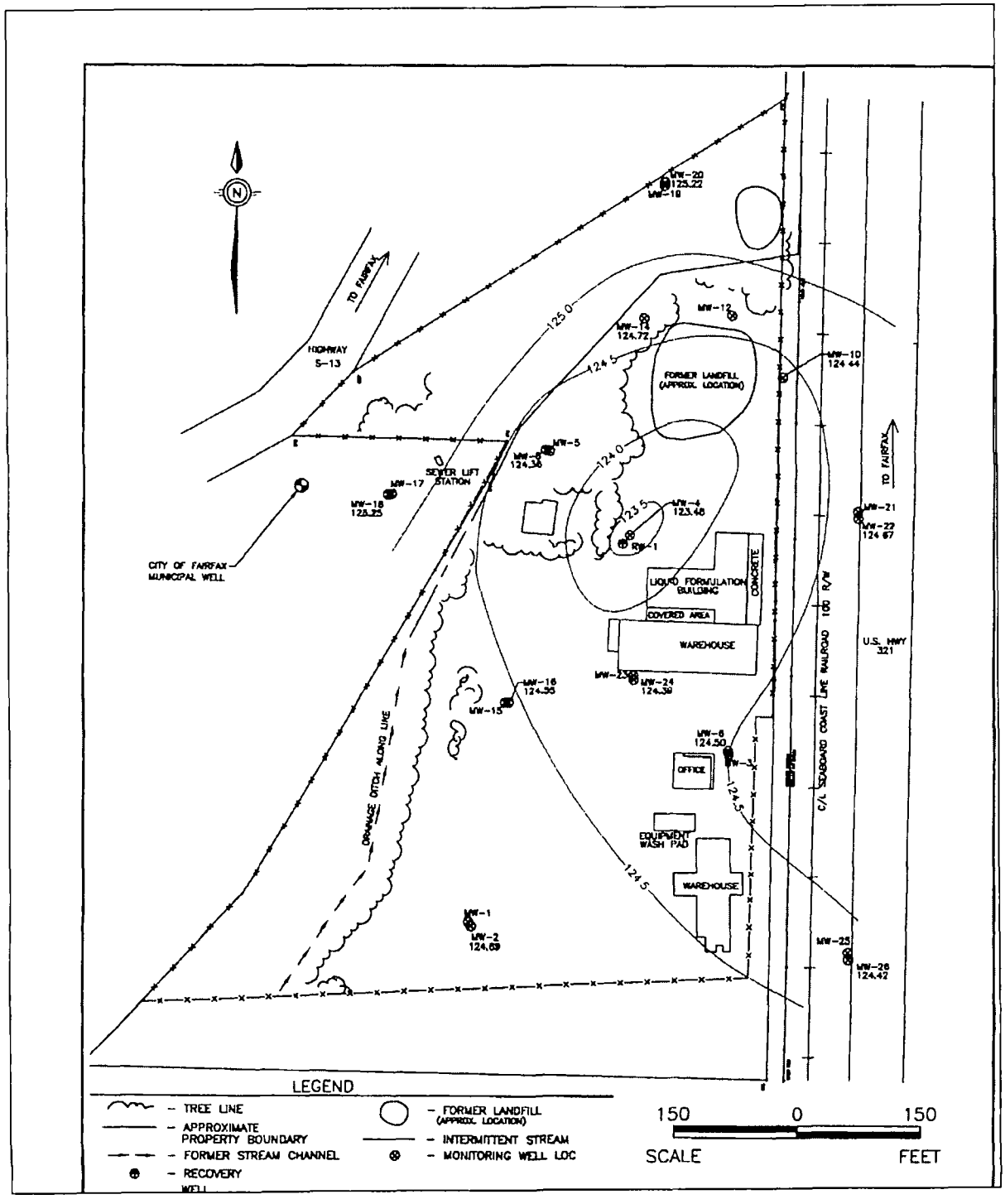
Attachment 5. Piezometric Surface (Shallow) as of February 25, 2004.



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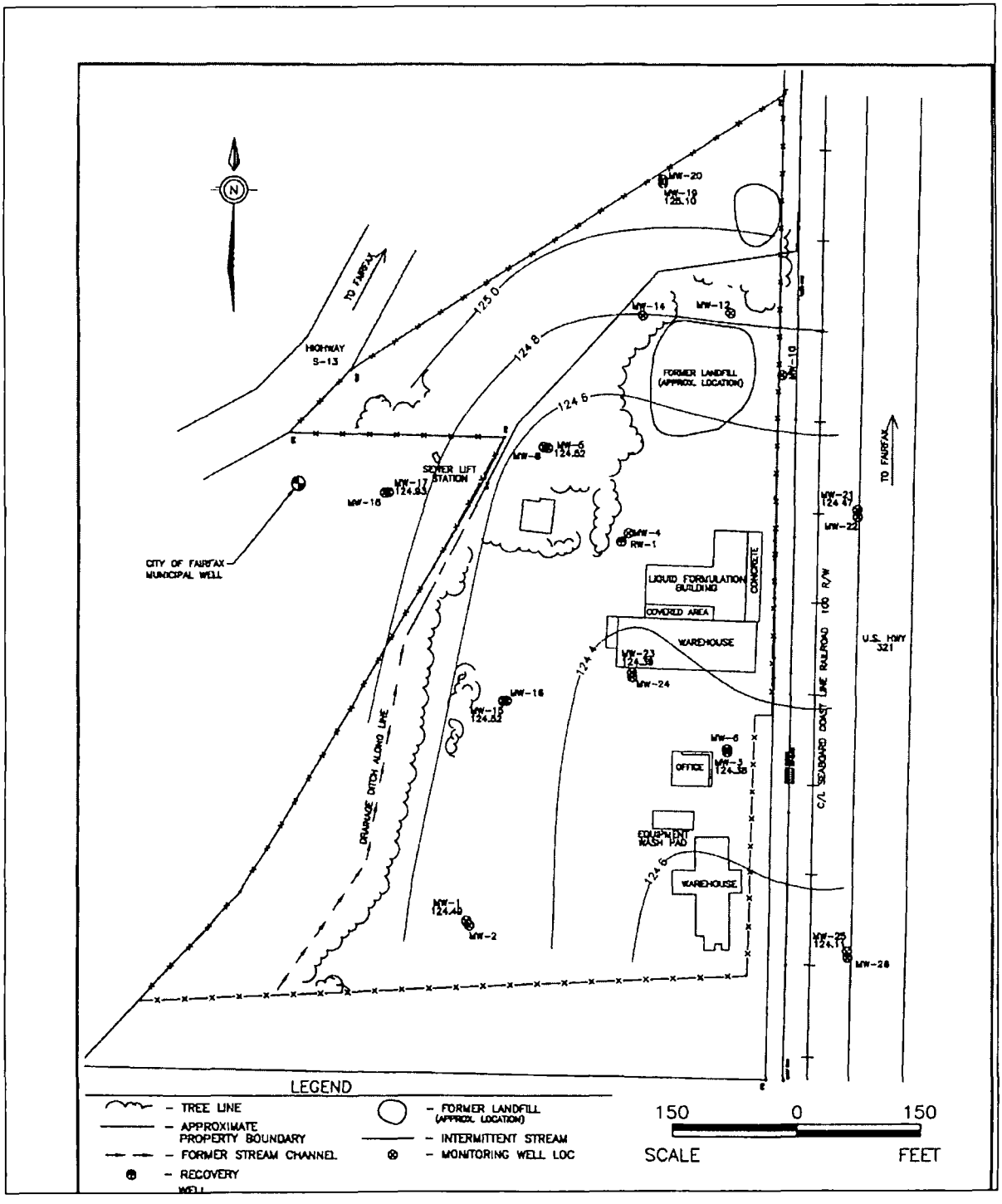
Attachment 6. Piezometric Surface (Deep) as of February 25, 2004



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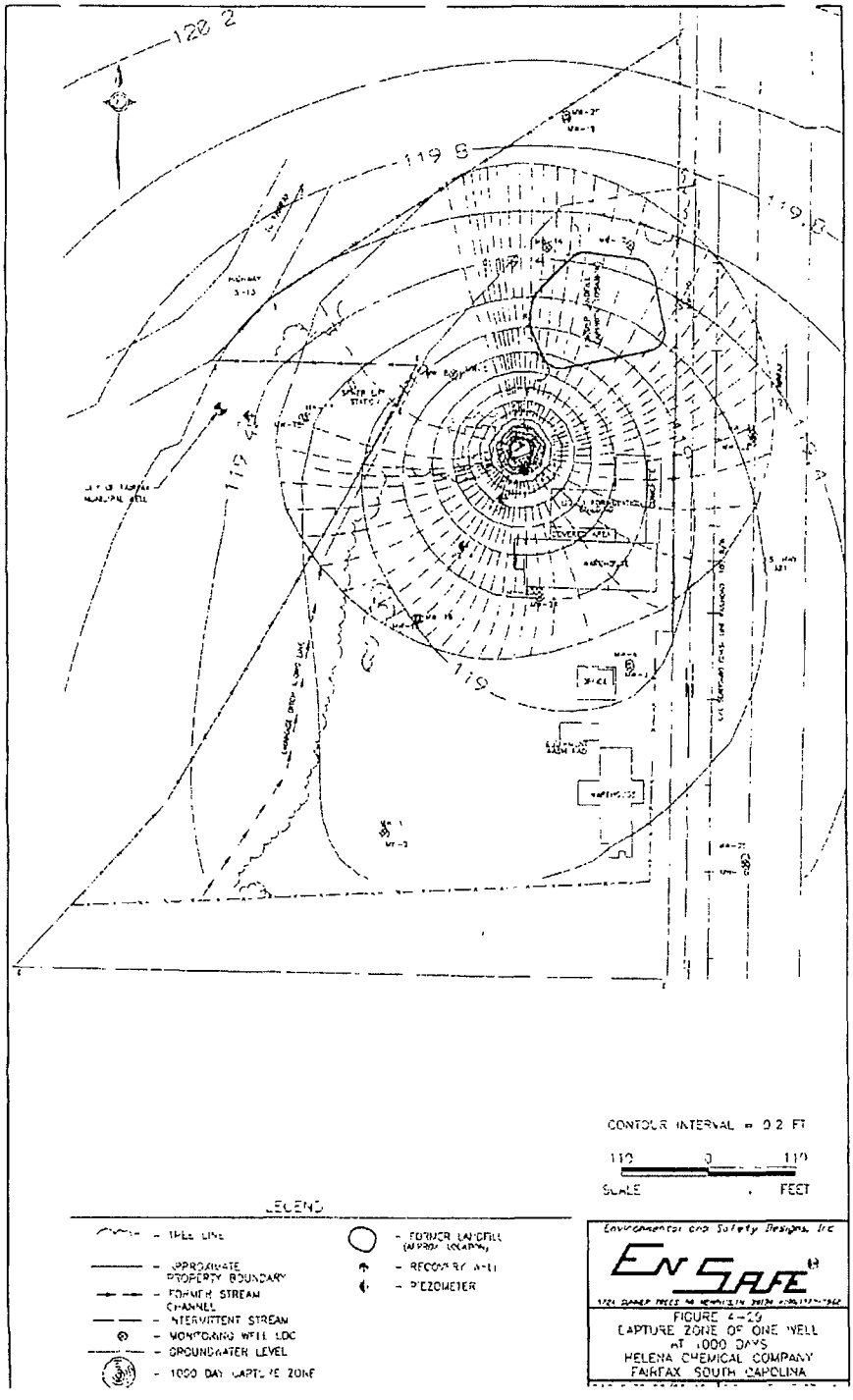
Attachment 7 Capture Zone of Recovery Well at 1,000 Days.



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Attachment 8. Industrial Discharge Permit

Town of Allendale

INDUSTRIAL USER

PERMIT

To discharge wastewater in accordance with the Town's Sewer Use Ordinance and Pretreatment Regulations

THIS CERTIFIES THAT

Helena Chemical

Has been granted permission to discharge wastewater from a facility located at

Fairfax, SC

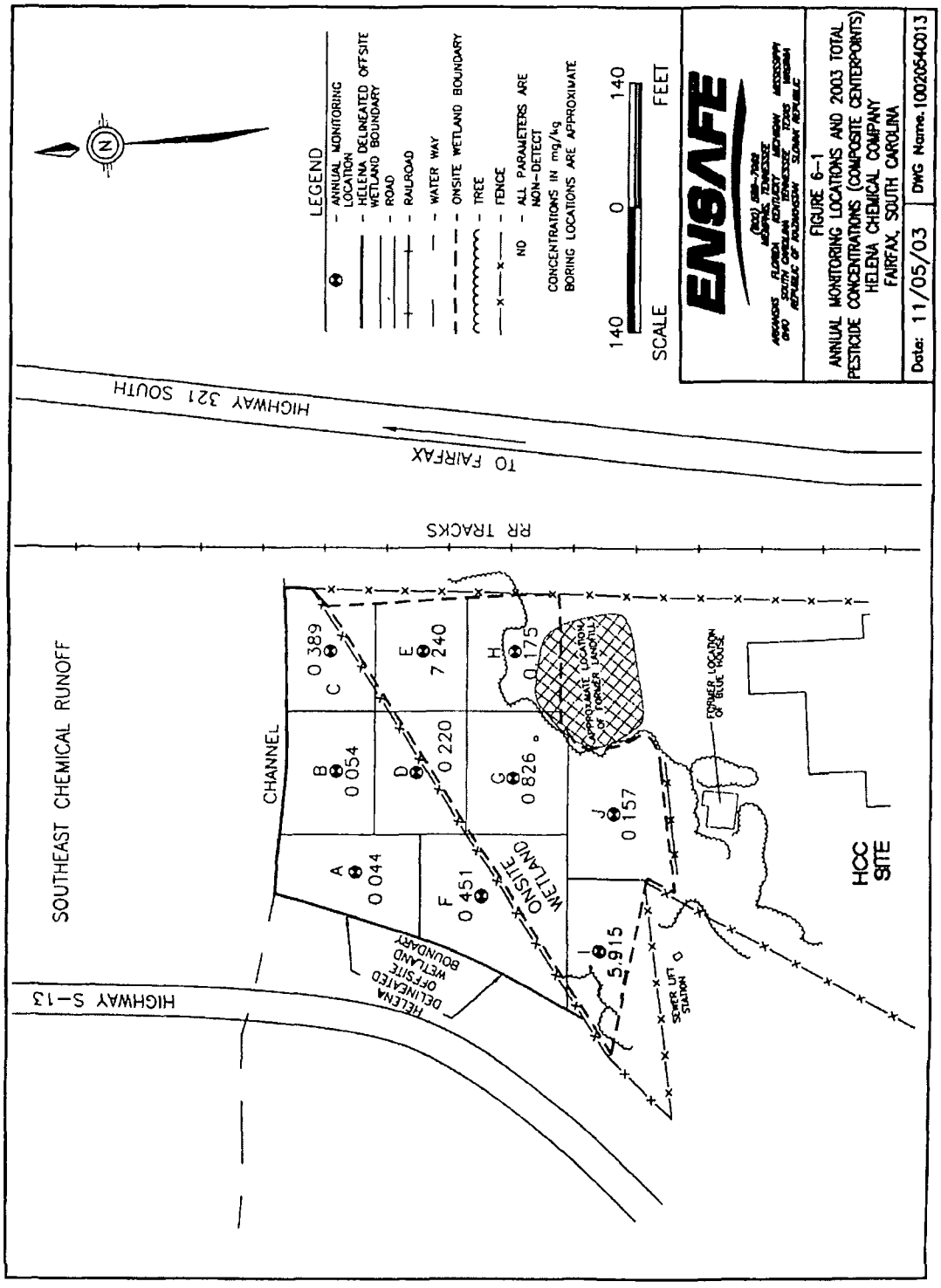
to the Town of Allendale's wastewater treatment system in accordance with effluent limitations, monitoring requirements and other conditions set forth in this permit This permit is issued in accordance with 40 CFR 403 and The Town of Allendale's Sewer Use Ordinance

Industrial Pretreatment Coordinator

Issued June 1, 2002 Expires May 31, 2007

Effective June 1, 2002 Permit No 4

Attachment 9. Sediment Sample Grid Locations



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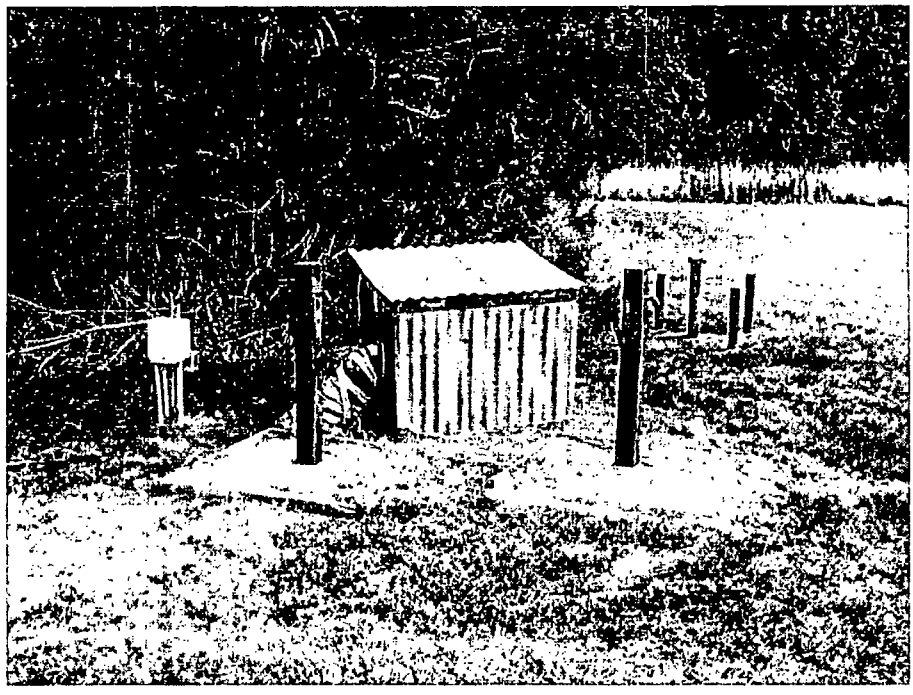
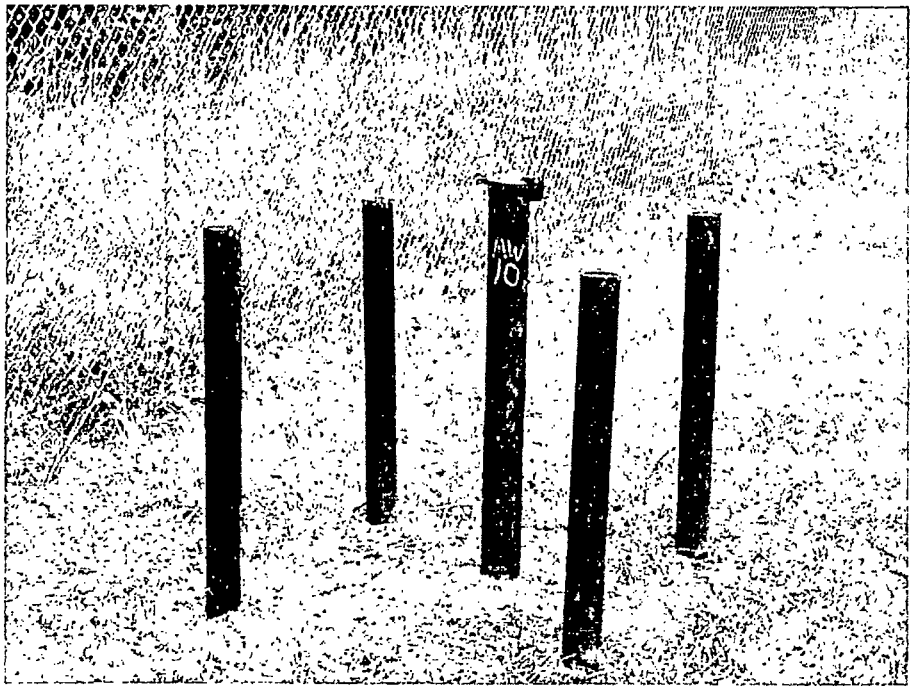
Attachment 10 - Site Photographs

Picture 10-1 Gated Entrance to the Helena Chemical Site



Picture 10-2 Housing for Recovery Well RW-1

Picture 10-3 Monitoring Well MW-4



Picture 10-4 Monitoring Well MW-10

Picture 10-5 Site Formerly Occupied by Landfill

Picture 10-6 Wetland Area Located on the Northern Site Boundary

FINAL

Attachment 11. - Site Inspection Checklist

FINAL

Site Inspection Checklist

I. SITE INFORMATION	
Site name: Helena Chemical Co. Landfill	**Date of inspection: April 20, 2004**
Location and Region: Fairfax, SC	**EPA ID:SCD058753971**
Agency, office, or company leading the five-year review. US Army Corps of Engineers, Chas. Dist.	**Weather/temperature: Sunny, 75°**

Remedy Includes (Check all that apply)

- √G Landfill cover/containment
- √G Access controls
- √G Institutional controls
- √G Groundwater pump and treatment
- G Surface water collection and treatment
- √G Other- Offsite Treatment via POTW
- √G Monitored natural attenuation
- G Groundwater containment
- G Vertical barrier walls

Attachments: G Inspection team roster attached G Site map attached

II INTERVIEWS (Check all that apply) **See Section VI of Report**

1 **O&M site manager** _____ _____ _____
Name Title Date
Interviewed G at site G at office G by phone Phone no _____
Problems, suggestions, G Report attached _____

2 **O&M staff** _____ _____ _____
Name Title Date
Interviewed G at site G at office G by phone Phone no _____
Problems, suggestions, G Report attached _____

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3	**Local regulatory authorities and response agencies** (i e , State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc) Fill in all that apply Agency _____ Contact _____ _____ _____ _____ Name Title Date Phone no Problems, suggestions, G Report attached _____ _____ Agency _____ Contact _____ _____ _____ _____ Name Title Date Phone no Problems, suggestions, G Report attached _____ _____ Agency _____ Contact _____ _____ _____ _____ Name Title Date Phone no Problems, suggestions, G Report attached _____ _____ Agency _____ Contact _____ _____ _____ _____ Name Title Date Phone no Problems, suggestions, G Report attached _____ _____
4	**Other interviews** (optional) G Report attached
	Refer to Report

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1	**O&M Documents**			
	G O&M manual	G Readily available	G Up to date	√G N/A
	G As-built drawings	G Readily available	G Up to date	√G N/A
	G Maintenance logs	G Readily available	G Up to date	√G N/A
	Remarks- Due to simplicity of operation, no detailed O&M documents required. Maintenance is performed regularly by qualified personnel			
2	**Site-Specific Health and Safety Plan**	√G Readily available	√G Up to date	G N/A
	G Contingency plan/emergency response plan	G Readily available	G Up to date	√G N/A
	Remarks			
3	**O&M and OSHA Training Records**	G Readily available	G Up to date	√G N/A
	Remarks			
4	**Permits and Service Agreements**			
	G Air discharge permit	G Readily available	G Up to date	√G N/A
	G Effluent discharge	G Readily available	G Up to date	√G N/A
	√G Waste disposal, POTW	√G Readily available	√G Up to date	G N/A
	G Other permits	G Readily available	G Up to date	√G N/A
	Remarks			
5	**Gas Generation Records**	G Readily available	G Up to date	√G N/A
	Remarks			
6	**Settlement Monument Records**	G Readily available	G Up to date	√G N/A
	Remarks			
7	**Groundwater Monitoring Records**	√G Readily available	√G Up to date	G N/A
	Remarks			
8	**Leachate Extraction Records**	G Readily available	G Up to date	√G N/A
	Remarks			
9	**Discharge Compliance Records**			
	G Air	G Readily available	G Up to date	G N/A
	√G Water (effluent)	√G Readily available	√G Up to date	G N/A
	Remarks			
10	**Daily Access/Security Logs**	G Readily available	G Up to date	√G N/A
	Remarks			

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IV. O&M COSTS

1 **O&M Organization**

G State in-house G Contractor for State
G PRP in-house √G Contractor for PRP
G Federal Facility in-house G Contractor for Federal Facility
G Other_____

2 **O&M Cost Records**

√G Readily available √G Up to date
G Funding mechanism/agreement in place
Original O&M cost estimate_____ G Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost
From_____ To_____ _____ G Breakdown attached
Date Date Total cost

3 **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons _____

V. ACCESS AND INSTITUTIONAL CONTROLS √G Applicable G N/A

A. Fencing

1 **Fencing damaged** √G Location shown on site map √G Gates secured G N/A

Remarks -Fence in good condition

B Other Access Restrictions

1 **Signs and other security measures** G Location shown on site map G N/A

Remarks- All observed wells were properly secured with padlocks

C. Institutional Controls (ICs)

1 **Implementation and enforcement**

Site conditions imply ICs not properly implemented G Yes √G No G N/A
Site conditions imply ICs not being fully enforced G Yes √G No G N/A

Type of monitoring (*e g* , self-reporting, drive by) Onsite employees
Frequency Daily
Responsible party/agency HCC
Contact _____ _____ _____ _____
Name Title Date Phone no

Reporting is up-to-date G Yes G No G N/A
Reports are verified by the lead agency G Yes G No G N/A

Specific requirements in deed or decision documents have been met G Yes G No G N/A
Violations have been reported G Yes G No G N/A
Other problems or suggestions G Report attached

2 **Adequacy** √G ICs are adequate G ICs are inadequate G N/A
Remarks

D. General

1 **Vandalism/trespassing** G Location shown on site map √G No vandalism evident
Remarks

2 **Land use changes on site** G N/A√
Remarks

3 **Land use changes off site** G N/A√
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads G Applicable G N/A√

1 **Roads damaged** G Location shown on site map G Roads adequate G N/A
Remarks

B. Other Site Conditions

Remarks _____

_____

_____

_____

_____

_____

VII. LANDFILL COVERS √G Applicable G N/A

A. Landfill Surface

1 **Settlement** (Low spots) G Location shown on site map √G Settlement not evident
Areal extent_____ Depth_____
Remarks_____
_____

2 **Cracks** G Location shown on site map √G Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____
_____

3 **Erosion** G Location shown on site map √G Erosion not evident
Areal extent_____ Depth_____
Remarks_____
_____

4 **Holes** G Location shown on site map √G Holes not evident
Areal extent_____ Depth_____
Remarks_____
_____

5 **Vegetative Cover** √G Grass √G Cover properly established √G No signs of stress
G Trees/Shrubs (indicate size and locations on a diagram)
Remarks_____
_____

6 **Alternative Cover (armored rock, concrete, etc.)** √G N/A
Remarks_____
_____

7 **Bulges** G Location shown on site map √G Bulges not evident
Areal extent_____ Height_____
Remarks_____
_____

8	**Wet Areas/Water Damage**	√G Wet areas/water damage not evident
	G Wet areas	G Location shown on site map Areal extent_____
	G Ponding	G Location shown on site map Areal extent_____
	G Seeps	G Location shown on site map Areal extent_____
	G Soft subgrade	G Location shown on site map Areal extent_____
	Remarks_____	
9	**Slope Instability** G Slides	G Location shown on site map √G No evidence of slope instability
	Areal extent_____	
	Remarks_____	

B. Benches G Applicable √G N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel)

1	**Flows Bypass Bench**	G Location shown on site map G N/A or okay
	Remarks_____	
2	**Bench Breached**	G Location shown on site map G N/A or okay
	Remarks_____	
3	**Bench Overtopped**	G Location shown on site map G N/A or okay
	Remarks_____	

C. Letdown Channels G Applicable √G N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies)

1	**Settlement**	G Location shown on site map G No evidence of settlement
	Areal extent_____	Depth_____
	Remarks_____	
2	**Material Degradation**	G Location shown on site map G No evidence of degradation
	Material type_____	Areal extent_____
	Remarks_____	
3	**Erosion**	G Location shown on site map G No evidence of erosion
	Areal extent_____	Depth_____
	Remarks_____	

4	**Undercutting** G Location shown on site map √G No evidence of undercutting Areal extent_____ Depth_____ Remarks_____
5	**Obstructions** Type_____ √G No obstructions G Location shown on site map Areal extent_____ Size_____ Remarks_____
6	**Excessive Vegetative Growth** Type_____ √G No evidence of excessive growth G Vegetation in channels does not obstruct flow G Location shown on site map Areal extent_____ Remarks_____
D. Cover Penetrations	G Applicable √G N/A
1	**Gas Vents** G ActiveG Passive G Properly secured/locked G Functioning G Routinely sampled G Good condition G Evidence of leakage at penetration G Needs Maintenance G N/A Remarks_____
2	**Gas Monitoring Probes** G Properly secured/locked G Functioning G Routinely sampled G Good condition G Evidence of leakage at penetration G Needs Maintenance G N/A√ Remarks_____
3	**Monitoring Wells** (within surface area of landfill) G Properly secured/locked G Functioning G Routinely sampled G Good condition G Evidence of leakage at penetration G Needs Maintenance √G N/A Remarks_____
4	**Leachate Extraction Wells** G Properly secured/locked G Functioning G Routinely sampled G Good condition G Evidence of leakage at penetration G Needs Maintenance G N/A√ Remarks_____
5	**Settlement Monuments** G Located G Routinely surveyed G N/A√ Remarks_____

E. Gas Collection and Treatment	G Applicable G N/A√	
1	**Gas Treatment Facilities** G Flaring G Thermal destruction G Collection for reuse G Good condition G Needs Maintenance Remarks_____	
2	**Gas Collection Wells, Manifolds and Piping** G Good condition G Needs Maintenance Remarks_____	
3	**Gas Monitoring Facilities** (*e g* , gas monitoring of adjacent homes or buildings) G Good condition G Needs Maintenance G N/A Remarks_____	
F. Cover Drainage Layer	G Applicable G N/A√	
1	**Outlet Pipes Inspected** G Functioning G N/A Remarks_____	
2	**Outlet Rock Inspected** G Functioning G N/A Remarks_____	
G. Detention/Sedimentation Ponds	G Applicable G N/A√	
1	**Siltation** Areal extent_____ Depth_____ G N/A G Siltation not evident Remarks_____	
2	**Erosion** Areal extent_____ Depth_____ G Erosion not evident Remarks_____	
3	**Outlet Works** G Functioning G N/A Remarks_____	
4	**Dam** G Functioning G N/A Remarks_____	

H. Retaining Walls	G Applicable G N/A√	
1	**Deformations** G Location shown on site map G Deformation not evident Horizontal displacement_____ Vertical displacement_____ Rotational displacement_____ Remarks_____	
2	**Degradation** G Location shown on site map G Degradation not evident Remarks_____	
I. Perimeter Ditches/Off-Site Discharge	G Applicable G N/A	
1	**Siltation** √G Location shown on site map G Siltation not evident√ Areal extent_____ Depth_____ Remarks_____	
2	**Vegetative Growth** G Location shown on site map G N/A √G Vegetation does not impede flow Areal extent_____ Type_____ Remarks_____	
3	**Erosion** G Location shown on site map G Erosion not evident√ Areal extent_____ Depth_____ Remarks_____	
4	**Discharge Structure** G Functioning G N/A√ Remarks_____	
VIII. VERTICAL BARRIER WALLS	G Applicable G N/A√	
1	**Settlement** G Location shown on site map G Settlement not evident Areal extent_____ Depth_____ Remarks_____	
2	**Performance Monitoring** Type of monitoring_____ G Performance not monitored Frequency_____ G Evidence of breaching Head differential_____ Remarks_____	

C. Treatment System	√G Applicable G N/A
1	**Treatment Train** (Check components that apply) G Metals removal G Oil/water separation G Bioremediation G Air stripping G Carbon adsorbers G Filters_____ G Additive (e g , chelation agent, flocculent)_____ G Others_____ G Good condition G Needs Maintenance G Sampling ports properly marked and functional G Sampling/maintenance log displayed and up to date G Equipment properly identified G Quantity of groundwater treated annually_____ G Quantity of surface water treated annually_____ Remarks Off site treatment by POTW_____
2	**Electrical Enclosures and Panels** (properly rated and functional) G N/A √G Good condition G Needs Maintenance Remarks_____
3	**Tanks, Vaults, Storage Vessels** G N/A√ G Good conditionG Proper secondary containment G Needs Maintenance Remarks_____
4	**Discharge Structure and Appurtenances** G N/A√ G Good conditionG Needs Maintenance Remarks_____
5	**Treatment Building(s)** G N/A√ G Good condition (esp roof and doorways) G Needs repair G Chemicals and equipment properly stored Remarks_____
6	**Monitoring Wells** (pump and treatment remedy) √G Properly secured/locked √G Functioning √G Routinely sampled √G Good condition √G All required wells located G Needs Maintenance G N/A Remarks_____
D. Monitoring Data	
1	Monitoring Data G Is routinely submitted on time√ G Is of acceptable quality√
2	Monitoring data suggests √G Groundwater plume is effectively contained G Contaminant concentrations are declining√

D. Monitored Natural Attenuation

1 **Monitoring Wells** (natural attenuation remedy)

√G Properly secured/locked √G Functioning √G Routinely sampled √G Good condition
√G All required wells located G Needs Maintenance G N/A
Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy An example would be soil vapor extraction

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed Begin with a brief statement of what the remedy is to accomplish (i e , to contain contaminant plume, minimize infiltration and gas emission, etc)

Refer to report

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures In particular, discuss their relationship to the current and long-term protectiveness of the remedy

Refer to report

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future None

I.	D. Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy None